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ABSTRACT

A descriptive summary of research at the University of Texas into the relationship between anxiety and performance is presented. Relevant research on the concepts of worry, emotionality, and state anxiety is reviewed. An instructional context involving a computer-managed course in educational psychology is described, along with the methodology used to study the relationships between each of four modules within the educational psychology course. The ability of the computer-managed curriculum to meet the demands for a research context which involves individualized instruction, behavioral objectives, and criterion-referenced test items is demonstrated. Significant results include the findings that the various measures of anxiety are highly correlated among each other and that worry is correlated more negatively and significantly with total performance scores than is either emotionality or state anxiety. (PB)

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Relationship of Anxiety and Performance in Computer Assisted Learning[1]

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This paper will summarize in a descriptive way some of the programmatic research effort concerning anxiety research of the Computer-Assisted Instruction Laboratory at The University of Texas at Austin. There are at least three major foci for this effort. First a need was identified to provide an instructional context in which to investigate both the impact of various instructional treatments on state anxiety and to investigate the relationship between state anxiety and performance. This instructional context should be designed and implemented so as to be individualized, and should use behavioral objectives and criterion-referenced test instruments in order to insure the results would be generalizable to what we hope will be the instructional systems of the future. Further, the instructional materials should be taught for college credit so as to insure realistic motivational levels and finally the number of students taking the course should be large enough to allow investigation of the various facets of the anxiety process as well as justify the cost of individualization.

In consequence, this past year we have focused on the design, development and implementation and evaluation of a five module computer-managed instruction curriculum in educational psychology which meets the above needs of an instructional context.

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A second focus was to provide further specification of the construct of anxiety and to determine the relationship among various measures of anxiety. In this symposium and elsewhere, a distinction concerning the cognitive and emotional aspects of the construct of anxiety have been mentioned. Further, the worry/emotionality scale has been used as a measure of anxiety by several of the other participants. In order to provide a bridge between their line of research and ours, the research I will talk about today uses three measures--the worry-emotionality scale as well as the state anxiety scale of the State-Trait Anxiety Inventory.

The third focus uses both the instructional context and the further specification of the construct of anxiety in an attempt to clarify the effects of anxiety on performance.

Instructional Context

A problem of concern to educators and psychologists is the determination of the effects of anxiety on the learning of the various curricula. Although it has been recognized that anxiety can interfere with the learning process (Sarason, 1960; Spielberger, 1966), relatively little research has been conducted for evidence of generalizability extending beyond the typical laboratory learning experiments (Spielberger, O'Neil, & Hansen, 1972).

The majority of studies concerning the debilitating effects of anxiety and learning have been conducted under relatively controlled and time limited conditions, using carefully developed experimental learning materials. For example, within computer-assisted instruction a number of investigations have found that level of state anxiety was related to task difficulty, i.e., high state anxiety was associated with different materials, low state anxiety

with easier materials. Further, high levels of state anxiety were associated with poor performance levels (O'Neil, 1972; O'Neil, Spielberger, & Hansen, 1969). Although the learning materials used in these studies were probably more meaningful to students than is typically the case in traditional laboratory experiments, the research was limited to observation of performance in a single experimental session.

As was mentioned, one purpose of the present research was to investigate the effects of state anxiety on the learning process over an extended time period in the form of a college course conducted via computer-managed instruction. In this respect, the generalizability of the prior anxiety results could be investigated within a real-life instructional situation over the period of a semester. The instructional situation we developed was computer-managed instruction.

In Computer-Managed Instruction, the instruction itself is not presented by the computer. Rather, the instruction is presented via a conventional, less expensive form of media. The student studies at his own rate, while the computer is used to monitor and direct his progress through the curricula. This is done by means of testing at frequent points in the program to diagnose the student's strengths and weaknesses, provide prescription, and schedule student use of available resources.

During the computer-managed instructional portion of introductory educational psychology, students spent two months studying five different instructional modules: (1) Computers in Education, (2) Statistics, (3) Classroom Management, (4) Tests and Measurement, and (5) Cultural Differences.

The course itself and consequently the CMI modules are required for teacher certification in the State of Texas. Thus every secondary education student teacher in the College of Education receives this instruction. The course averages 1000 students a year. Guided by behavioral objectives, each student studied conventional printed learning resources until he finished the readings for a module; after this, he came to the CAI Laboratory to take a criterion-referenced test, also keyed to the objectives, on a computer terminal. He received feedback at the end of the test consisting of his total score on the module and his percentage score on each objective. If he failed to meet an 80% criterion, he was required to take a retest at a later date, at which time he was tested only over the previously failed objectives.

Data concerning the test and retest performance of all students who took the five CMI modules as part of their introductory educational psychology course are presented in Table 1. As a measure of student performance, percentages of the students who reached criterion (80%) on module tests and retests were computed. The overall instructional effectiveness of the CMI modules is supported by these data.

Further Specification of the Construct of Anxiety

A number of researchers have found it useful (following Spielberger, 1966) to differentiate conceptually between anxiety as a transitory state and as a relatively permanent trait.

According to Spielberger (1966, pp. 16-17), "anxiety states" (A-State) are characterized by subjective, consciously perceived feelings of apprehension and tension accompanied by or associated with activation or arousal of the autonomic nervous system. Anxiety as a personality trait (A-Trait) would seem to imply a motive or acquired behavioral disposition that predisposes

an individual to perceive a wide range of objectively non-dangerous circumstances as threatening, and to respond to these with A-State reactions disproportionate in intensity to the magnitude of the objective danger.

The State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970) was developed to measure both anxiety as a transitory state and as a relatively permanent trait. The research I will report uses a five-item form of the State Anxiety Scale. This permits *in vivo* measurements of state anxiety instead of inferences about anxiety by means of trait measures or performance scores.

Reliability and validity data for the five-item scale have been summarized by O'Neil (1972). He reports that alpha reliabilities of the scale for subjects involved in computer-assisted learning tasks and computer-based intelligence tests range from .83 to .93 in 17 administrations of the scale. This points to a high internal consistency for the scale in these areas of research.

In support of the scale's construct validity, O'Neil (1972) reports four studies in which state anxiety varied as a function of task difficulty, and in which high levels of state anxiety were debilitating to performance. Further validity data can be found in the manual of the State-Trait Anxiety Inventory.

In a recent review of test anxiety literature, Wine (1971) suggests that a cognitive factor is the principal component accounting for the inverse relationship between task performance and test anxiety. The original basis for her observation was drawn from a factor-analytic study of the Test Anxiety Questionnaire which reported two general classes of factors: (a) cognitive factors, related to confidence about intelligence testing or

examinations; and (b) autonomic arousal factors, such as perspiration and heartbeat (Sassenrath, 1964).

Liebert and Morris (1967) reviewed Sassenrath's study and named the cognitive class of factors the "worry" component of test anxiety; autonomic arousal factors were called an "emotionality" component. Worry is defined as cognitive concern over performance; emotionality signifies reported autonomic arousal due to the stress of an immediate testing situation. They constructed a 10-item Worry-Emotionality Scale, composed of five "worry" and five "emotionality" items from the Test Anxiety Questionnaire, modified so that the responses reflected the subject's immediate feelings relative to a specific testing situation.

Morris and Liebert (1970) report alpha-reliability coefficients of .69 and .68 for the Worry Scale and .76 and .83 for the Emotionality Scale. Three studies have supported the construct validity of the Worry-Emotionality Scale's dual factor measurement of situational test anxiety (Doctor & Altman, 1969; Morris & Liebert, 1969, 1970). In general, these studies indicate that the "Worry" component of test anxiety correlates significantly with performance on subscales of a timed IQ test, lower examination grades, and lower performance expectancy among subjects, while the "Emotionality" component does not correlate with these variables. Based on these findings, Morris and Liebert (1970) conclude that Worry accounts for more of the debilitating effects of test anxiety than Emotionality.

It is of interest in this research effort to investigate the relationship between worry and emotionality and state anxiety. Further, the future relationships of each of these measures to performance will be investigated.

Methodology

Subjects

The subject pool consisted of all students taking the introductory classes in educational psychology for secondary education majors at The University of Texas at Austin in the spring of 1972. Approximately 95% of the students volunteered for this and other CAI Laboratory research. For this study, of the students who volunteered, 74 were males and 141 were females.

The subjects also differed in the fact that there are two major tracks within the educational psychology curriculum. One is an experimental program of proctor-assisted instruction in which lecture-demonstration is minimized and personalization of instruction is maximized. In addition, a strict schedule with deadlines for accomplishment of tasks is enforced. In contrast, the non-proctor-assisted instruction sections relied heavily on lecture-demonstration and the degree of monitoring and enforcement of deadlines varied from teaching assistant to teaching assistant.

Apparatus

An IBM 1500 Computer-Assisted Instructional System was used for the presentation of all computer-managed module tests, the Test Anxiety Scale, the Worry-Emotionality Scale, and the five-item State Anxiety measure. Presentation of test items and the anxiety measures, as well as recording of all subject responses, took place at the system's terminals. Each terminal consisted of a cathode ray tube for the presentation of materials, and a typewriter keyboard for the entering of responses. The terminals were located in an air-conditioned room and were separated by sound-insulated walls. A computer data management system automatically recorded all pertinent data.

Procedures

All students were administered the test anxiety scale during a demonstration of procedures of how to use the computer terminals. Following each CMI test the students received the anxiety scales with retrospective stake instructions, i.e., "tell me how you felt during the test you just took." The anxiety scales consisted of the worry and emotionality scales as well as the five item short form of the state anxiety scales. Each student proceded through the CMI system for all modules.

Results and Discussion

To investigate the relationship between various anxiety measures (worry; emotionality; and state anxiety) and performance on each of the four modules, Pearson Product Moment correlations were computed. As may be seen in Table 2, the various measures of anxiety are highly correlated among each other, for example, on the Computer in Education module, state anxiety is correlated with worry .6594, and with emotionality .8037. This pattern of state anxiety being more highly correlated with emotionality than with worry was true in all four modules. Further a statistical test of the difference between the correlational coefficients (Hays, 1963) indicated that these differences were statistically significant for all modules. Further, as may also be seen in Table 2, worry was more often significantly negatively correlated and generally more highly correlated with total performance scores than was either emotionality or state anxiety.

In summary the instructional effectiveness of the computer-managed instructional curriculum in educational psychology meets the demands of a research context for anxiety research in that it is individualized, uses

behavioral objectives and criterion-referenced test items. Even in the context of high performance levels, it is striking that for some students anxiety is debilitating to performance.

The research reported by Richardson (1973) focuses on automated therapy-like interventions to both reduce anxiety and improve performance. In addition to further work in that area, we also are planning instructional-like interventions to both reduce anxiety and improve performance in the CMI context. For example, we will develop a memory module through which students will receive instruction on improving their memory ability and thus hopefully improving their performance. There is some theoretical and empirical basis provided by Dr. Sieber-Suppes (1969) for the fact that anxiety interferes with memory. Thus we may be able to improve performance in spite of high anxiety levels as we have short circuited the debilitating effect of anxiety by improving the memory ability of our students.

The further specification of the construct of anxiety into a worry component and an emotionality component seems to have empirical advantages in that worry was more often correlated with performance than were state anxiety or emotionality. Our next focus will be to select items from both the worry and state anxiety scale that reliably and validly discriminate successful and unsuccessful students in the CMI context. Work has begun on this using discriminative function analysis to select items. The fall CMI effort will utilize these new items.

In conclusion, the results of this study, in which the effects of instructional treatments on state anxiety and performance were investigated over several months reflect both the complexity and the potential significance of this research methodology. Within any individualized course, learning

situation and conditions were sufficiently unstructured to permit idiosyncratic learning strategies to be used which is not typically the case in more laboratory-controlled experiments. Thus, a number of ancilliary, uncontrolled variables may have obscured or delimited the possible influences of experimental treatments on anxiety and the impact of anxiety on performance. However, the observed results were generally consistent with reported findings from laboratory settings.

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